U.S. Army Center for Health Promotion and Preventive Medicine

USCHPPM

EPICON FINAL REPORT

ACUTE GASTROENTERITIS OUTBREAK IN FIELD ARTILLERY TRAINEES
FORT BLISS, TEXAS
AUGUST 1998

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Readiness Thru Health

U.S. Army Center for Health Promotion and Preventive Medicine

The lineage of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) can be traced back over 50 years. This organization began as the U.S. Army Industrial Hygiene Laboratory, established during the industrial buildup for World War II, under the direct supervision of the Army Surgeon General. Its original location was at the Johns Hopkins School of Hygiene and Public Health. Its mission was to conduct occupational health surveys and investigations within the Department of Defense's (DOD's) industrial production base. It was staffed with three personnel and had a limited annual operating budget of three thousand dollars.

Most recently, it became internationally known as the U.S. Army Environmental Hygiene Agency (AEHA). Its mission expanded to support worldwide preventive medicine programs of the Army, DOD, and other Federal agencies as directed by the Army Medical Command or the Office of The Surgeon General, through consultations, support services, investigations, on-site visits, and training.

On 1 August 1994, AEHA was redesignated the U.S. Army Center for Health Promotion and Preventive Medicine with a provisional status and a commanding general officer. On 1 October 1995, the nonprovisional status was approved with a mission of providing preventive medicine and health promotion leadership, direction, and services for America's Army.

The organization's quest has always been one of excellence and the provision of quality service. Today, its goal is to be an established world-class center of excellence for achieving and maintaining a fit, healthy, and ready force. To achieve that end, the CHPPM holds firmly to its values which are steeped in rich military heritage:

★ *Integrity is the foundation*
★ *Excellence is the standard*
★ *Customer satisfaction is the focus*
★ *Its people are the most valued resource*
★ *Continuous quality improvement is the pathway*

This organization stands on the threshold of even greater challenges and responsibilities. It has been reorganized and reengineered to support the Army of the future. The CHPPM now has three direct support activities located in Fort Meade, Maryland; Fort McPherson, Georgia; and Fitzsimons Army Medical Center, Aurora, Colorado; to provide responsive regional health promotion and preventive medicine support across the U.S. There are also two CHPPM overseas commands in Landstuhl, Germany and Camp Zama, Japan who contribute to the success of CHPPM's increasing global mission. As CHPPM moves into the 21st Century, new programs relating to fitness, health promotion, wellness, and disease surveillance are being added. As always, CHPPM stands firm in its commitment to Army readiness. It is an organization proud of its fine history, yet equally excited about its challenging future.

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An outbreak of gastroenteritis hospitalized 99 US Army trainees at Fort Bliss, TX, between 27 AUG - 01 SEP 98. Case mapping demonstrated geographic clustering inconsistent with contamination of the general water supply. The nature of the outbreak and the presenting symptoms of the soldiers were most consistent with a naturally occurring viral gastroenteritis outbreak. Analysis of questionnaire data revealed a strong association between illness and one dining facility. A strong association between dining facility soft drink dispensers was also found. Interviews with dining facility personnel revealed that one worker, a baker, had been ill while working in the early morning hours of 26 AUG 98. No single source (food, beverage, or individual) was identified as causing all disease. On 18 SEP 98, the Viral Gastroenteritis Branch, Centers for Disease Control and Prevention reported identification of a calicivirus in 15 of 20 stool samples from ill trainees. Stringent enforcement of safe food handling practices, particularly the immediate removal of ill food workers from food preparation areas, was recommended.

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EXECUTIVE SUMMARY
ACUTE GASTROENTERITIS OUTBREAK IN FIELD ARTILLERY TRAINEES
FORT BLISS, TEXAS
AUGUST 1998

An outbreak of acute gastroenteritis caused the hospitalization of 99 US Army trainees at Fort Bliss, TX between 27 AUG - 01 SEP 98. As the cause and source of the outbreak was not immediately obvious, William Beaumont Army Medical Center (WBAMC) requested assistance with the outbreak investigation from the US Army Center for Health Promotion and Preventive Medicine Epidemiology Consultation (EPICON) Service. A six-person EPICON team arrived on 31 AUG 98 in response to the request. Working closely with Fort Bliss medical, veterinary, engineer, and food handler personnel, the EPICON team conducted an exhaustive investigation over the next four days. Case mapping of the outbreak demonstrated a discrete geographic clustering inconsistent with widespread contamination of the post water supply. The nature of the outbreak and the presenting symptoms of the soldiers were most consistent with a naturally occurring viral gastroenteritis outbreak. The suspected agent was a Norwalk or Norwalk-like (*Calicivirus* family) virus. Preliminary (univariate) analysis of questionnaire data revealed a strong association between dining facility 1002 and illness. Other evidence corroborated this finding and pinpointed the suspect meals as breakfast and lunch on Wednesday, 26 AUG 98. A strong association between dining facility soft drink dispensers was also found during preliminary analysis. Interviews with dining facility personnel revealed that one worker, a baker, had been ill while working in the early morning hours of 26 AUG 98. The EPICON team was not able to conclusively identify a single source (food, beverage, or individual) as causing all disease. On 18 SEP 98, the Viral Gastroenteritis Branch, Centers for Disease Control and Prevention reported identification of a *calicivirus* in 15 of 20 stool samples from ill Fort Bliss trainees. The recommendation of the EPICON team was stringent enforcement of safe food handling practices as outlined by WBAMC Preventive Medicine and Fort Bliss Veterinary personnel. This recommendation, particularly the immediate removal of ill food workers from the food preparation area, was discussed at length with food service management personnel. The superb handling of the outbreak by Fort Bliss and WBAMC officials undoubtedly decreased the secondary spread of the outbreak.

Acute Gastroenteritis Outbreak in Field Artillery Trainees, Aug 98

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ACUTE GASTROENTERITIS OUTBREAK IN FIELD ARTILLERY TRAINEES
FORT BLISS, TEXAS
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1. HISTORICAL BACKGROUND. Shortly after midnight on Friday, 28 AUG 98, 15 Advanced Individual Training (AIT) students from the 1/56 Regiment, 6th Air Defense Artillery (ADA) Brigade presented to the WBAMC Emergency Room complaining of one or more of the following symptoms: nausea, vomiting, diarrhea, fever/chills, and headache. LTC Don Skillman, WBAMC Infectious Disease Service, immediately notified MAJ Chris Jenkins, WBAMC Chief, Preventive Medicine Service, of a potential food-borne acute gastroenteritis (AGE) outbreak. Preliminary information from those first presenting indicated a possible common source of dining facility (DFAC) 1002. This led MAJ Jenkins to close that facility at 0330 Friday, 28 AUG 98. As the weekend progressed, more AIT soldiers presented to WBAMC with similar symptoms but differing exposure histories. COL Theodore McNitt, WBAMC Deputy Commander for Clinical Services, activated an onsite Deployable Medical System (DEPMEDS) hospital and directed all AIT soldiers with AGE symptoms (and only those with AGE symptoms) be admitted to the DEPMEDS hospital for treatment and observation.

On Sunday, 30 AUG 98, with more than 90 admissions in less than three days and no obvious etiology, WBAMC officials requested assistance from the US Army Center for Health Promotion and Preventive Medicine (USACHPPM) Epidemiology Consultation Service (EPICON). In response to this request, LTC Brian Feighner (USACHPPM) and LTC Ted Cieslak, US Army Medical Research Institute of Infectious Diseases (USAMRIID), departed Baltimore on 30 AUG 98 and reported to Fort Bliss at 0530 on 31 AUG 98. Four additional members of the team arrived at Fort Bliss late on Monday, 31 AUG 98. The EPICON team included:

Team Member	Unit	Position
LTC Brian Feighner	USACHPPM	Team Leader
LTC Ted Cieslak	USAMRIID	Operational Medicine
LTC Edward Hoedebecke	USACHPPM	Veterinary Public Health
Maj Mark Arness	USUHS	PM Resident
Michelle Canham	USACHPPM	Epidemiologist
Christina Polyak	USACHPPM	Epidemiologist

2. PURPOSE / OBJECTIVES. The EPICON team's first mission was to confirm the existence of an outbreak. If an outbreak was confirmed, the team's mission was to determine the etiology of the outbreak and recommend evidenced-based measures for control and prevention.

3. METHODS. The EPICON team quickly joined forces with WBAMC and Fort Bliss officials to investigate the outbreak. Active-duty admissions to WBAMC for AGE are an unusual occurrence, with a total of only 19 admissions in the previous 52 weeks. The admission of 77 in a 24-hour period confirmed the outbreak. For investigational purposes, a case of AGE was defined on 31 AUG 98 as vomiting and/or diarrhea (three or more loose stools in a 24-hour period) in the previous 10 days. Interviews with patients, food handlers, engineers, veterinary food inspection personnel, and line officers were immediately conducted. LTC Carlson, the 1/56 ADA Regimental commander, led the team on a tour of the AIT student area, including DFACs, barracks, and recreational areas. Fort Bliss is an old, established US Army post in El Paso, TX. It is the site of ADA training for the US Army. AIT, the training of soldiers that occurs immediately after completion of basic training, is performed by the 1/56 ADA Regiment of the 6th ADA Brigade. The 1/56 Regiment is comprised of four batteries. Alpha, Bravo, and Charlie batteries are composed of soldiers receiving their initial AIT training. Delta Battery is composed of veteran soldiers who are leaving their previous military occupational specialty (MOS) to retrain as ADA soldiers. Alpha, Bravo, and Charlie soldiers have extremely regimented schedules. Delta battery soldiers, by virtue of their seniority, enjoy greatly expanded privileges with respect to eating, drinking, and off-post travel. One visible example of this disparity is that all Alpha, Bravo, and Charlie, but not Delta, students must wear a web belt with a full canteen of water at all times.

All AIT students live in a segregated, five by three block rectangular compound. Two DFACs serve the student compound, DFAC 1002 and DFAC 1006. While some dining preferences were expressed, the soldiers march to the dining area and are given 25 minutes to eat and return to formation. Thus, where each unit eats is a function of where they are directed by the Drill Instructor and/or which DFAC has the shortest line at any given meal. The length of ADA AIT training differs by MOS. The training is comprised of classroom, simulator, and live-fire work at several different sites on and off-post. In addition to the roughly 800 US Army soldiers, small numbers of US Marines, German, and Japanese trainees also use these facilities.

Maps of Fort Bliss (several scales) were collected. Personnel Daily Status Reports and training schedules were obtained from the 1/56 ADA Regiment. Sign-in rosters, menus, and meal preparation paperwork were obtained from the DFACs. Limited food samples from both DFACs had been obtained and were sent to the DoD Veterinary Laboratory, Fort Sam

Houston, TX, for bacterial toxin analysis. Cultures of the soft ice cream dispensers were obtained. Post water production was reviewed and water distribution maps were obtained from the Fort Bliss engineers. Recent construction possibly involving water lines was reviewed. Water samples were taken from several sites in the AIT student area and other sites on post. El Paso City Health Department officials were contacted. A food-borne outbreak questionnaire was devised and given on 31 AUG 98 to 34 soldiers who were departing on 01 SEP 98.

WBAMC medical personnel collected stool samples on all AGE admissions with diarrhea. All were examined for fecal leukocytes and cultured for *Salmonella*, *Shigella*, *Campylohacter*, and *Yersinia* (bacterial pathogen) species. Additionally, the first 15 stool samples were processed for the less common bacterial pathogens *Aeromonas*, *Plesiomonas*, and *E. coli* O157:117. The first 15 samples were also evaluated for ova parasites, including staining for *Cyclospora* and *Cryplospiridia*. WBAMC personnel also collected acute sera on more than 60 AGE patients. The EPICON team recommended sending stool samples to both the Walter Reed Army Institute of Research (WRAIR) and the Centers for Disease Control and Prevention (CDC) for analysis for viral pathogens. No vomitus was available for analysis.

The EPICON team abstracted data from inpatient records of those admitted to WBAMC. The team administered a food-borne outbreak questionnaire to those admitted and a group of AIT students who had not sought medical care. The team also abstracted data from the DFAC sign-in rosters. Due to time passed since probable exposure (a week or more), a food preference format using foods on the previous week's menu rather than a meal-by-meal menu was used. The team conducted additional, intensive interviews with presumed high-yield individuals, including an ill food handler and two lieutenants who were ill but did not normally associate with the AIT students.

4. RESULTS. A spot map of the outbreak demonstrated all but three of the known cases occurred in AIT students who live in a discrete geographic area (the AIT student compound). The water supply at Fort Bliss is derived entirely from deep well (aquifer). The treated water is pumped into one of several water towers around post. The water distribution system is a closed loop system. The tight geographic distribution of cases was not consistent with proximal contamination of the water distribution system. Construction in the area had required a nearby water main to be closed and opened on Thursday, 27 AUG 98 only. General sanitation of the DFACs appeared satisfactory. No sinks or hoses in the DFACs were found to represent back-siphoning hazards. The soft drink dispensers had anti-siphoning valves in place.

No pathogenic bacteria were recovered from the stool samples. No ova or parasites were seen in the stool samples; no fecal leukocytes were found. One water sample (of several dozen) was positive: the plain water from the DFAC 1006 soft drink dispenser sample grew *Enterobacter cloacae*, a coliform. The soft ice cream from DFAC 1002 grew coliform bacteria (*Citrobacter diversus* and *Serratia liquefaciens*), however; there was some question as to how long this sample had been at room temperature before culture. This uncertainty led the EPICON team to discount the importance of these findings.

Six patients remained in the hospital on 31 AUG 98 for examination by the team. The team was able to locate and abstract 90 of 99 inpatient records. The history and physical was recorded on a pre-printed form. The inpatient data are presented in Tables 1- 3. Unit-specific admission rates are given in Table 4.

Table 1. Frequency of Presenting Symptoms, 1998 Fort Bliss AGE Outbreak

Symptom	Number	(%)
Nausea	79/90	88%
Vomiting	72/90	80%
Abdominal Pain	68/90	76%
Diarrhea	60/90	67%
Fever / Chills	37/90	41%
Headache	20/90	22%
Photophobia or Eye Pain	3/90	3%

Table 2. Frequency of Selected Findings (in inpatients). 1998 Fort Bliss AGE Outbreak

Sign / Finding	Number	(%)
Tmax > 99.5 F	28/90	38%
Tmax > 100.4 F	17/90	19%
WBC > 10,600	10/60	17%
Platelets < 150,000	22/60	37%

Table 3. Length of Stay. 1998 Fort Bliss AGE Outbreak

Days	Number	(%)
1	72/90	80%
2	17/90	19%
3	1/90	1%

Table 4. Admission Rates by Battery, 1998 Fort Bliss AGE Outbreak

Battery*	Admitted / Strength**	(%)
A	21/160	13%
B	16/193	8%
C	30/207	14%
D	2/225	1%
USMC	7/ 50	14%
All US Students	99/835	12%

*Not all inpatient records recorded battery.
** Personnel strength on 27 AUG 98, less hospitalized, confined, AWOL, and on leave.

Two of the three non-AIT student cases were Second Lieutenants awaiting assignment. They interacted with the AIT students on only two occasions during the week of 23 AUG. On Wednesday, 26 AUG 98 they ate lunch at DFAC 1002. Their menus had only two things in common, soft drinks from the DFAC machine and pudding pie. On Thursday, 27 AUG 98 they attended a live-fire exercise with AIT Students. They did not eat or drink anything in common with the AIT students on Thursday. Of the 15 Japanese soldiers interviewed, nine had been ill. The Japanese soldiers ate only breakfast and dinner (not lunch) at the DFACs during the week in question.

A baker at DFAC 1002 reported being ill at work. He arrived for his shift at 2345 hours 25 AUG 98 and became abruptly-ill around 0200 26 AUG 98. He reported several episodes of emesis. Unable to reach a replacement, he continued working his shift until 0445. He denied diarrhea that morning - his last day of work at the DFAC. Other workers reported finding vomitus and diarrheal stool in the DFAC women's latrine when they arrived that morning. During this shift, the baker made cinnamon rolls, crumb cake, and pudding pie. The crumb cake and cinnamon rolls were served at breakfast 26 and 27 AUG 98; the pudding pie was served at lunch on 26 AUG 98.

The questionnaire was given to 323 students: 284 US soldiers, 24 US Marines, and 15 Japanese soldiers. No German soldiers were surveyed. Of the 99 students admitted to the hospital, 86 completed the questionnaire. The 237 controls, i.e., those not admitted to the hospital, were to be a randomized sample of those not admitted (last SSN numeral 3, 5, or 7). Examination of their SSNs reveals the sample to be a haphazard sample of approximately 35% of those not admitted. Approximately 14% of these 4 controls also met the case definition for AGE. The epidemiologic curve as derived from questionnaire data is seen in Figure 1.
In an effort to identify the point source of the outbreak, cases with onset on 27 -28 AUG 98 were termed 'first wave' cases. Onsite, preliminary analysis of the questionnaire data revealed the following univariate odds ratios (multivariate analysis performed later):

Table 5. Univariate and Multivariate Analysis of Questionnaire Data: Odds Ratios of Selected Exposures vs. "First Wave Case". 1998 Fort Bliss AGE Outbreak

	UNIVARIATE		MULTIVARIATE	
Exposure	OR*	95% CI**	OR#	95% CI**
Ate at DFAC 1002	9.8	(2.8,40.7)	4.7	(1.02, 21.5)
DFAC Soft Drink	3.8	(2.0,7.2)	2.4	(1.2,4.8)
Ate more at DFAC 1002	3.7	(2.0,6.9)	2.4	(1.3,4.5)
Crumb Cake	2.4	(1.2,4.8)	1.8	(0.8, 3.8)
DFAC Ice Cream	1.7	(1.1,2.7)	1.1	(0.6,2.0)
Cinnamon Roll	1.7	(0.8,3.5)	1.3	(0.6,3.0)
DFAC Ice	1.5	(0.8,2.9)	1.1	(0.5,2.3)

* An univariate odds ratio is a simple measure of association between an exposure and an outcome. Specifically, it is a point estimate of the odds that an ill person had the exposure divided by the odds that a non-ill person had the same exposure. Generally speaking, the higher the odds ratio, the more the exposure is incriminated.

** The 95% Confidence Interval is that interval which, given the collected data, would be expected to contain the true odds ratio with 95% certainty. If the 95% Confidence Interval for an odds ratio includes the number one (1), the association is considered not statistically significant.

The multivariate (multiple logistic regression) odds ratio attempts to express the association between exposure and illness with greater biostatistical sophistication. The multivariate odds ratio for a given exposure is often explained as the odds ratio obtained while holding the effects of all other variables constant.

5. DISCUSSION. There was no evidence of bacterial infection, bacterial toxin, or the use of a BW agent. There was no significant association of disease with any demographic variable. Epidemiologic evidence implicated the DFAC 1002 breakfast and lunch meals on Wednesday, 26 AUG 98. Although being assigned to Delta battery was protective, DFAC 1002 remained significantly associated with disease among those in Delta battery (OR 6.9, (1.5, 35.6)). Analysis of the food preference data suggests a potential role of the DFAC soft drink dispenser and possibly some baked goods as risk factors for AGE. No one item, other than soft drinks from the DFAC dispenser, was reported as consumed in numbers large enough to attribute the first wave of disease to consumption of one item. Alternatively, several food items may have been contaminated and the carbonated beverages may have acted as a co-factor, facilitating infection.

The outbreak is estimated to have affected at least 200 soldiers: the 99 hospitalized cases, the 40 additional cases found among the 237 'controls' surveyed, and an estimated additional 60 cases among those not surveyed. The outbreak was essentially over as the EPICON team arrived. The epidemiologic curve was most consistent with a propagated, point source outbreak. The clinical, microbiologic, and additional epidemiologic analyses all pointed to a naturally occurring outbreak of viral gastroenteritis. The most likely agent was felt to be a Norwalk-like virus (*calicivirus*). The EPICON team was not able to conclusively identify a single source (food, beverage, or individual) as causing all disease. Unintentional contamination by a food handler was suspected, but not conclusively demonstrated by the EPICON team.

On 18 SEP 98, the Viral Gastroenteritis Section, CDC reported identification of a *calicivirus* (Genotype 2 strain) by reverse transcriptase-polymerase chain reaction in 15 of 20 Fort Bliss stool samples tested. These Norwalk-like viruses (NLVs), previously known as Small Round-Structured Viruses (SRSVs), are the most common cause of nonbacterial gastroenteritis outbreaks in adults.[1-4] NLVs, recently classified in the family *Caliciviridae*, are transmitted by the fecal-oral route. They have been implicated in 42-71% of viral outbreaks associated with contaminated water and food since the Norwalk virus was first identified in 1972.[1-4] NLV outbreaks have been attributed most commonly to consumption of contaminated raw shellfish and unsanitary personal hygiene food preparation practices by food handlers.[3,4] Following the sequencing of the Norwalk virus genome and the development of reverse transcriptase-polymerase chain reaction detection assays, NLVs have been divided into two genogroups, G-1 and G-2, with Norwalk virus and Snow Mountain virus representing the prototype strains, respectively.[5,6] NLVs are hardy, ubiquitous, and extremely persistent in the environment, resisting disinfection and chlorination, and have been documented to cause serial gastroenteritis outbreaks.[1-3]

Of particular interest in this outbreak were foods prepared by the confection baker on the morning of 26 AUG, when he became ill. Bakery goods and contaminated 7 cake frosting have been previously identified as sources of large NLV AGE outbreaks. Crumb cake, pie and cinnamon rolls (prepared by the ill baker) were weakly associated with illness by univariate analysis; this association was not confirmed by multivariate analysis. The strong association with carbonated beverages may represent crosscontamination of surfaces, as NLVs are resistant to disinfection and can survive on surfaces. Another possibility is a biological effect of carbonated beverages as a co-factor for infection, possibly related to increased viral survival with higher pH.[8,9] All of the epidemiologic evidence in this outbreak is consistent with a point-source, propagated, food-borne viral illness. Circumstantial evidence points to contamination of foods in DF I by the ill confection baker, although confirmatory diagnostic stool and serum tests were unavailable. Water as a source was ruled out, and a weak - association with DF1 ice was statistically non-significant. The use of the Army hospital as a quarantine bay likely decreased secondary propagation of the outbreak.

6. CONCLUSIONS / RECOMMENDATIONS. Fort Bliss line officers and WBAMC officials were quick to respond with superb control and prevention measures. The use of the DEPMEDS hospital to effectively quarantine cases undoubtedly decreased secondary propagation of the outbreak. No evidence was found to support super-chlorination of the water distribution system of other engineering maneuvers. The EPICON team noted strict adherence to standard food handler sanitation guidelines would minimize, but not eliminate, the possibility of recurrence. The particular importance of preventing ill food handlers from working at any DFAC was discussed at length in meetings between the EPICON team, WBAMC Preventive Medicine staff and DFAC management.

In spite of high standards in the U.S. food preparation industry, the universal nature and persistence of NLVs makes future recurrence of viral AGE outbreaks a virtual certainty. Prevention of future occurrences in U.S. military dining facilities is dependent upon vigilance and rigorous enforcement of basic hygiene and sanitation measures.

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Figure 1. Cases of viral gastroenteritis admitted to the Army Medical Center in El Paso over the year prior tc the Norwalk-like viral gastroenteritis outbreak.

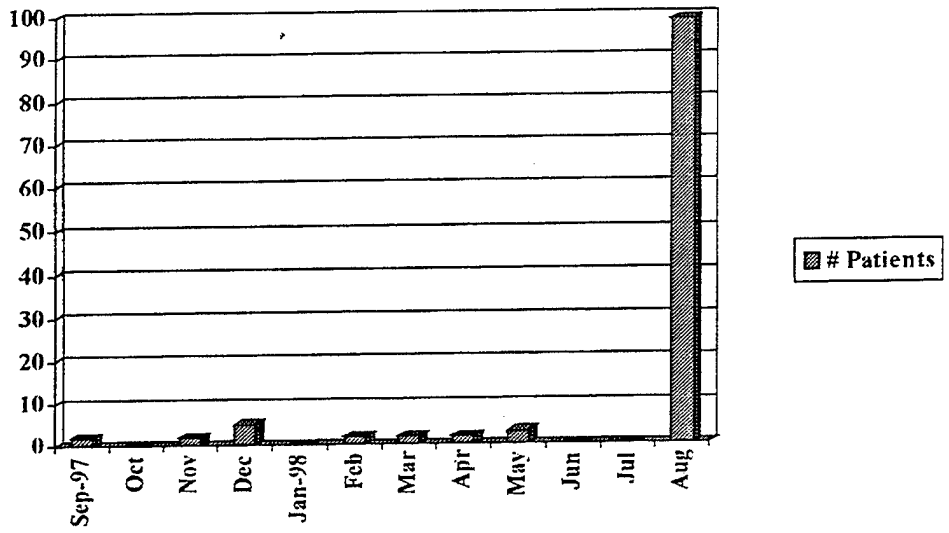

Figure 2. Date of onset of AGE symptoms in 126 cases for the week of 24 Aug 98.